

Second law implications of the size dependency in the adiabatic phase transition of Type I superconductors

Peter D. Keefe

*University of Detroit Mercy, College of Engineering and Science, 4001 W. McNichols Road,
Detroit, MI 48221, USA*

The phase transition of a mesoscopic Type I superconductor involves thermal and electrodynamic relaxation processes of the control variables, the electrodynamic relaxation being three orders of magnitude faster than the thermal relaxation. This potentially renders the time differences of the control variables observable and non-isentropic, but only if the phase transition is abrupt. [1-7] An experiment [8] investigating the phase transition of macroscopic wires and mesoscopic whiskers discovered the mesoscopic sized phase transition is abrupt, whereas the macroscopic sized phase transition is continuous.

The talk will discuss the Second Law implications.

- [1] P.D. Keefe, Quantum mechanics and the second law of thermodynamics: an insight gleaned from magnetic hysteresis in the first order phase transition of an isolated mesoscopic size Type I superconductor, T151, 014029, IOP Publishing (2012).
- [2] P.D. Keefe, The second law of thermodynamics and quantum heat engines: Is the law strictly enforced?, *Physica E: Low-dimensional Systems and Nanostructures*, Vol. 42, Issue 3, Jan. 2010, Pgs 461-465.
- [3] P.D. Keefe, Quantum limit to the second law by magneto-caloric effect, adiabatic phase transition of mesoscopic-size Type I superconductor particles, *Physica E*, Vol. 29, Oct. 2005, Pgs 104-110.
- [4] P.D. Keefe, Second Law Implications of a Magnetocaloric Effect Adiabatic Phase Transition of Type I Superconductor Particles, *Journal of Modern Optics*, V. 51, No. 16-18, pp 2727-2730, 10-12/2004.
- [5] P.D. Keefe, Second Law Violation By Magneto-Caloric Effect Adiabatic Phase Transition of Type I Superconductor Particles, *Entropy*, V. 6, pp. 116-127, 03/2004.
- [6] P.D. Keefe, Coherent Magneto-Caloric Effect Superconductive Heat Engine Process Cycle, *Journal of Modern Optics*, V. 50, No. 15-17, pp 2443-2454, 10-11/2003.
- [7] P.D. Keefe, Coherent-Magneto-Caloric Effect Heat Engine Process Cycle, 1st International Conference on Quantum Limits to the Second Law, AIP Conference Proceedings No. 643, pp. 213-218, 09/2002.
- [8] O.S. Lutes and E. Maxwell, Superconducting Transitions in Tin Whiskers, *Phys. Rev.*, 97, 1718 (1955).